SOT-05123304025-KF-E6

Frequency Synthesizer Module, Low Phase Noise
0.05 to 22.6 GHz

SOT-05123304025-KF-E6 is a low phase noise frequency synthesizer module that covers a frequency range of 0.05 to 22.6 GHz. The model works with 100 MHz external reference. The output power of the module is +4 dBm with ± 5 dB power flatness. The frequency step resolution of the module is up to 0.1 mHz. The oscillator has a built-in voltage regulator to further improve the signal quality and provide over voltage protection. The normal operating state of the oscillator is externally referenced. This module can be directly controlled with digital signals following SPI communication protocol through 53261-0671-7P Connector. An evaluation kit including the control board to operate this synthesizer can be purchased separately under M/N: SOT-EVA-S1†.

Electrical Specifications:

Parameter	Minimum	Typical	Maximum
Output Frequency Range	0.05 GHz		22.6 GHz
Step Size		0.1 mHz	
Output Power		+4 dBm	
Output Power Flatness		± 5 dB	
Frequency Stability	Same as External Reference		
Frequency Accuracy	Same as External Reference		
Output Spurious		-70 dBc	-65 dBc
Output Harmonics			-5 dBc
External Reference	100 MHz/ +7 dBm ± 3 dBm		
Lock Indicator (LD)	TTL High		
Phase Noise*	REF Phase Noise + (20 Log (N) + 3) dBc/Hz		
Frequency Switching Time	≤25 us (Excludes the Port Communication Time)		
Control Interface	SPI		
DC Voltage		+12 V_{DC}	+15 V_{DC}
DC Supply Current		600 mA	700 mA
Specification Temperature		+25°C	
Operating Temperature	-40°C		+70°C

** N is the frequency multiplication factor.*

†The frequency-hopping and sweep function in SOT-EVA-S1 are not supported when the software is used with the high-speed SOT-05123304025-KF-E6 (25 µs) module.

ECCN

EAR99

FEATURES

- Low Phase Noise
- Low Harmonics Components
- External Referenced
- SPI Communication Port

APPLICATIONS

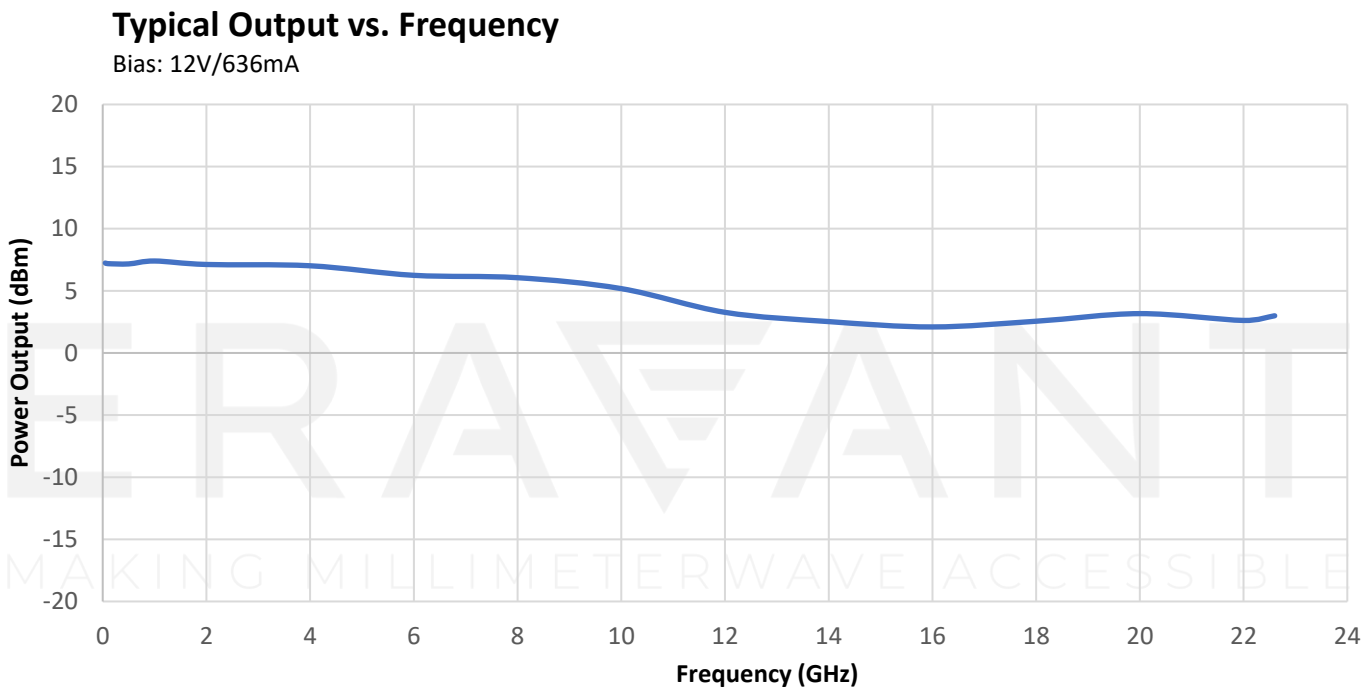
- Radar Systems
- Communication Systems
- Test instrumentations

SUPPLEMENTAL DETAILS

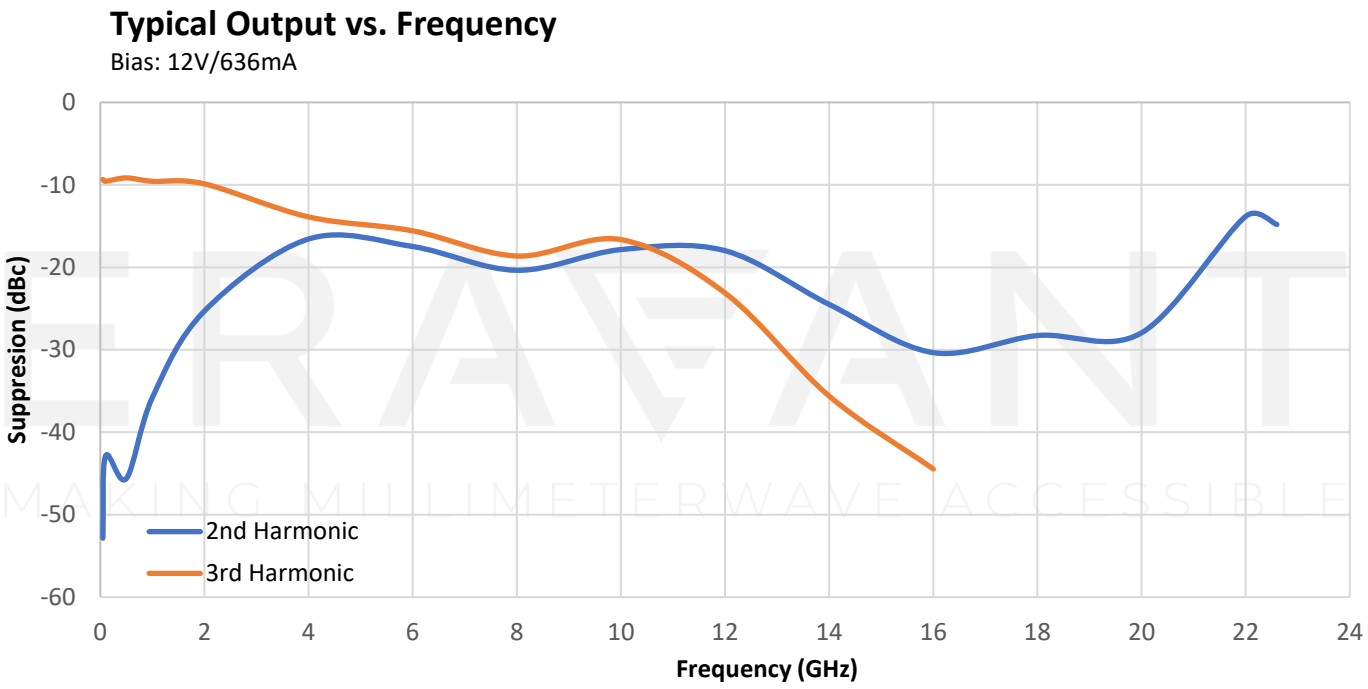
Mechanical Specifications:

Item	Specification
RF Output	K (F) Connector
Bias and Control Port	53261-0671-7P Connector
Lock Indicator (LD)	53261-0671-7P Connector
External Reference Input Port	SMA (F) Connector
Body Material	Aluminum
Finish	Nickel Plated
Weight	2.8 Oz
Size	1.97” (L) x 1.97” (W) x 0.51” (H)
Outline	OT-EC-SM4

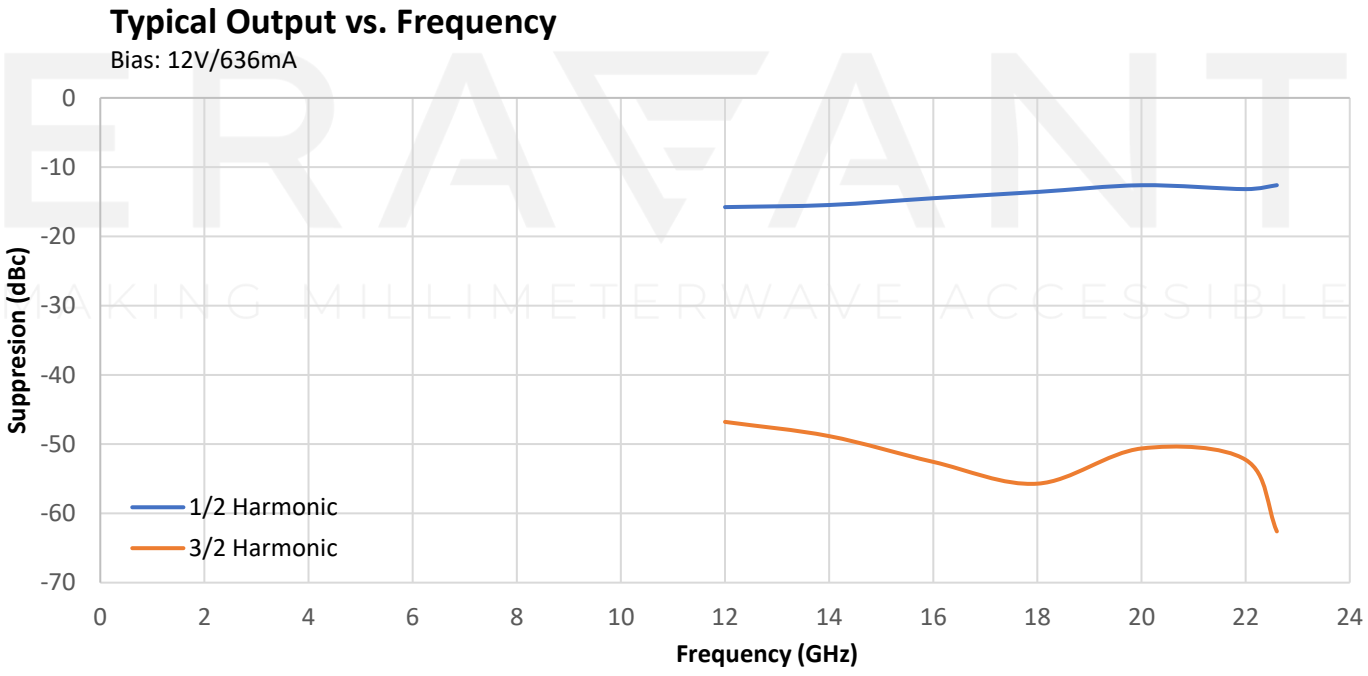
Measured Output Power vs. Frequency



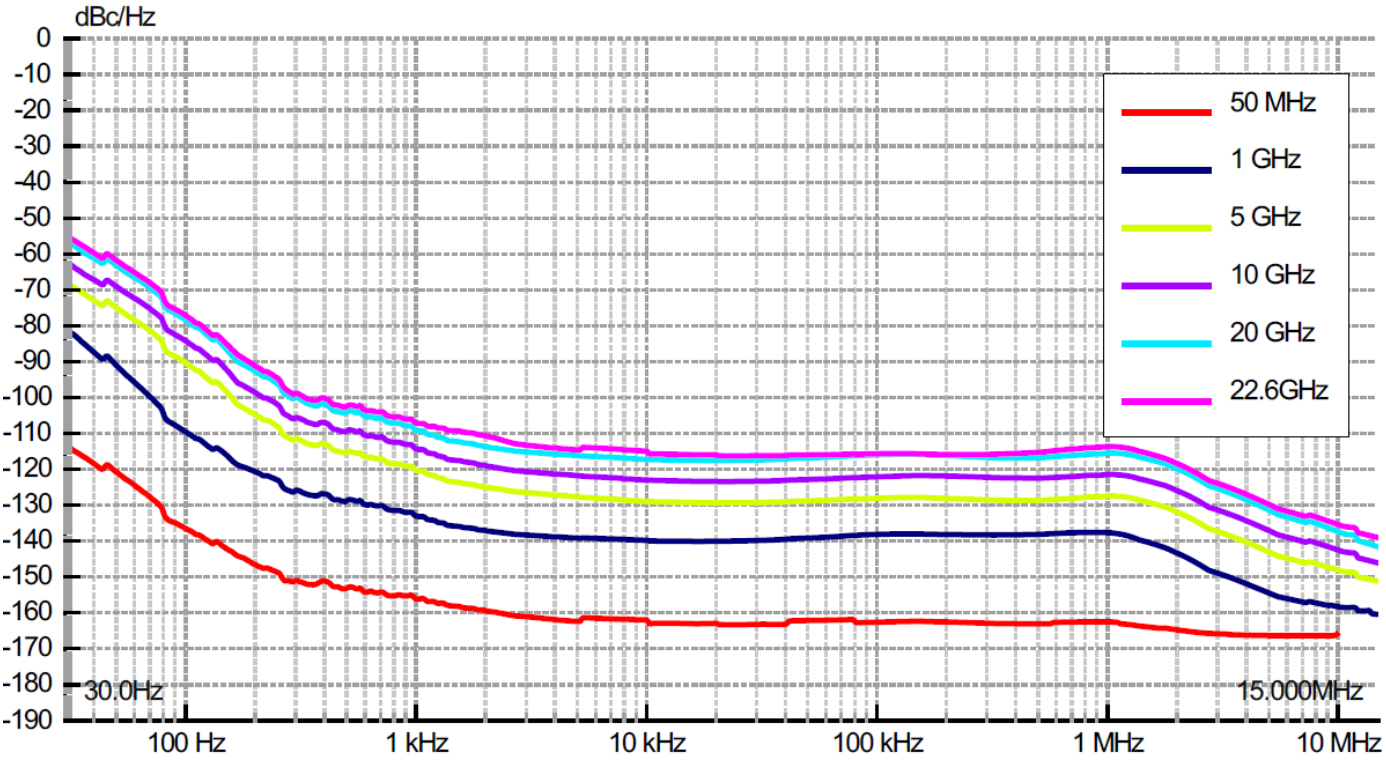
Measured Harmonic Suppression vs. Frequency (2nd and 3rd)



Measured Harmonic Suppression vs. Frequency (1/2 and 3/2)

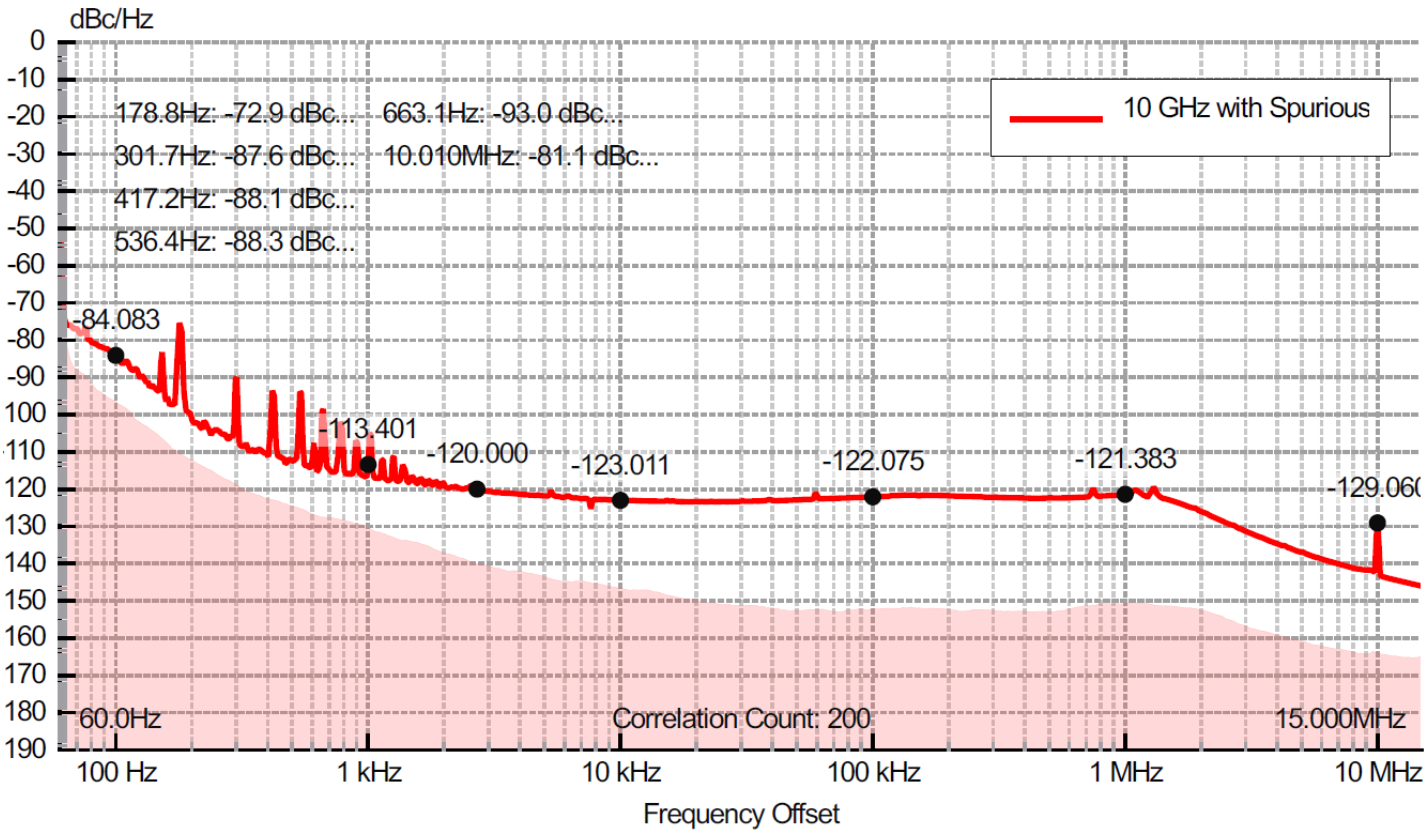


***Typical Phase noise at Different Carrier Frequencies**



Frequency Offset	1 GHz	5 GHz	10 GHz	22.6 GHz
100 Hz	-100 dBc/Hz	-80 dBc/Hz	-75 dBc/Hz	-81 dBc/Hz
1 kHz	-123 dBc/Hz	-109 dBc/Hz	-103 dBc/Hz	-105 dBc/Hz
10 kHz	-139 dBc/Hz	-128 dBc/Hz	-122 dBc/Hz	-116 dBc/Hz
100 kHz	-138 dBc/Hz	-127 dBc/Hz	-122 dBc/Hz	-116 dBc/Hz
1 MHz	-137 dBc/Hz	-127 dBc/Hz	-121 dBc/Hz	-114 dBc/Hz

* Measured Phase noise at 10GHz with Spurious Table

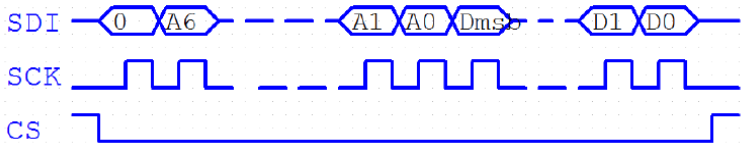


10 GHz with Spurious	DUT Info	Jitter Stats	Marker Freq	Value [dBc/Hz]	Spur Freq	Value [dBc]
S/N: HA7062D-147	Freq: 9.9999991400GHz	Start: 1.00kHz	100.0Hz	-84.08	178.8Hz	-72.86
Type: Absolute	Power: 4.650 dBm	Stop: 10.000MHz	1.00kHz	-113.40	301.7Hz	-87.59
Date: 2025-04-16	Gain: 42 dB	Jitter: 27.038 fs	10.00kHz	-123.01	417.2Hz	-88.06
Time: 15:03:08	Acq: 3 m: 34 s	Noise: 9.734e-02°	100.00kHz	-122.08	536.4Hz	-88.35
Temp: 39.46°C	Offset: 60.0Hz		1.000MHz	-121.38	663.1Hz	-92.96
Limit Test: None	# Correlations: 200		10.000MHz	-129.06	10.010MHz	-81.06

* *The phase noise data is taken with external reference:*

Frequency Offset	100 Hz	1 kHz	10 kHz	100 kHz
Phase Noise	-130 dBc/Hz	-156 dBc/Hz	-169 dBc/Hz	-172 dBc/Hz

Communication Port:



The device is controlled with a SPI communication port. Digital high level (TTL High) is +3.3 V, and its effective range is from +2.7 V to +3.6 V; digital low level (TTL Low) is 0 V and its effective range is from 0 to +0.6 V. To send a control signal to this module, the W/R bit is first sent, followed by register address, and data.

W/R Control Register Bit:

High-order Bit (W/R)	Definition	Note
0	Write	-
1	Read	Reserved

Register Map and Bit Descriptions:

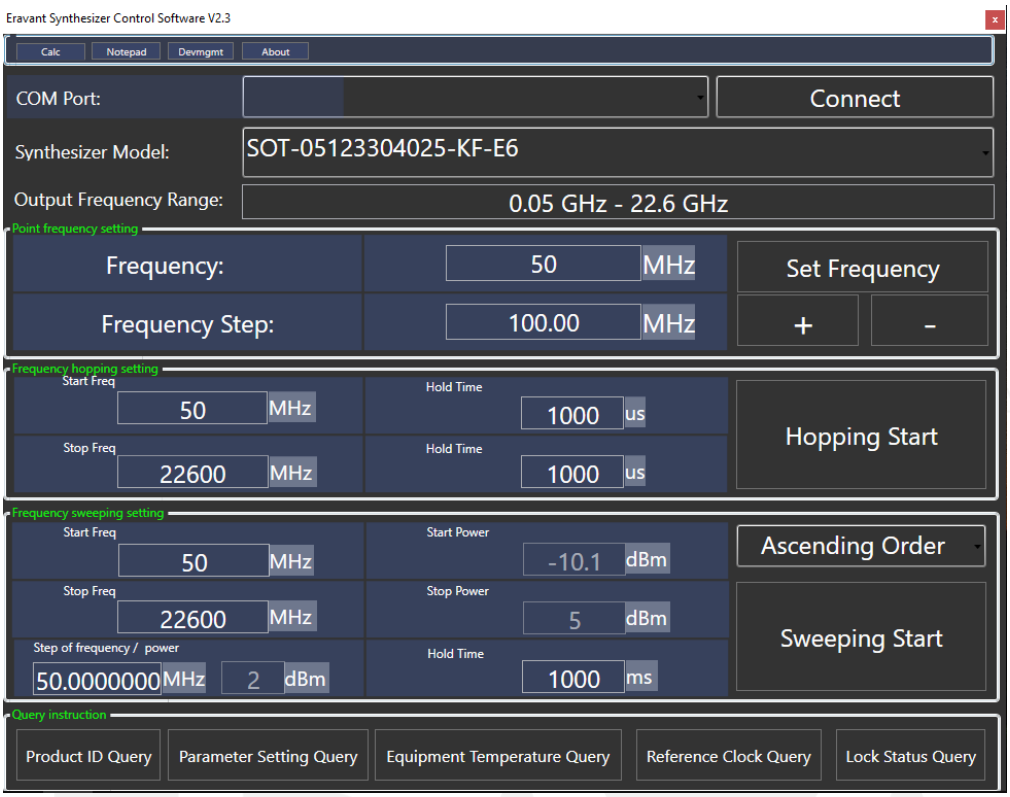
Register Address	Bit Range	Description	Default Value
0x01*	[79:16]	Synthesized Frequency	0x00005AF3107A4000
	[15:0]	Reserved	0x0000
Register Address	**Bit Range**	**Description**	**Default Value**
0x02**	[63:16]	Synthesized Frequency	0x00174876E800
	[15:0]	Reserved	0x0000

*The unit of synthesized frequency is 0.1 mHz. For example, when frequency is synthesized to 5 GHz, the data in bits [79:16] is 50000000000000. The data sent through SPI is 0x01_00002D79883D2000_0000. The default synthesized frequency is 10 GHz (0x01_00005AF3107A4000_0000).

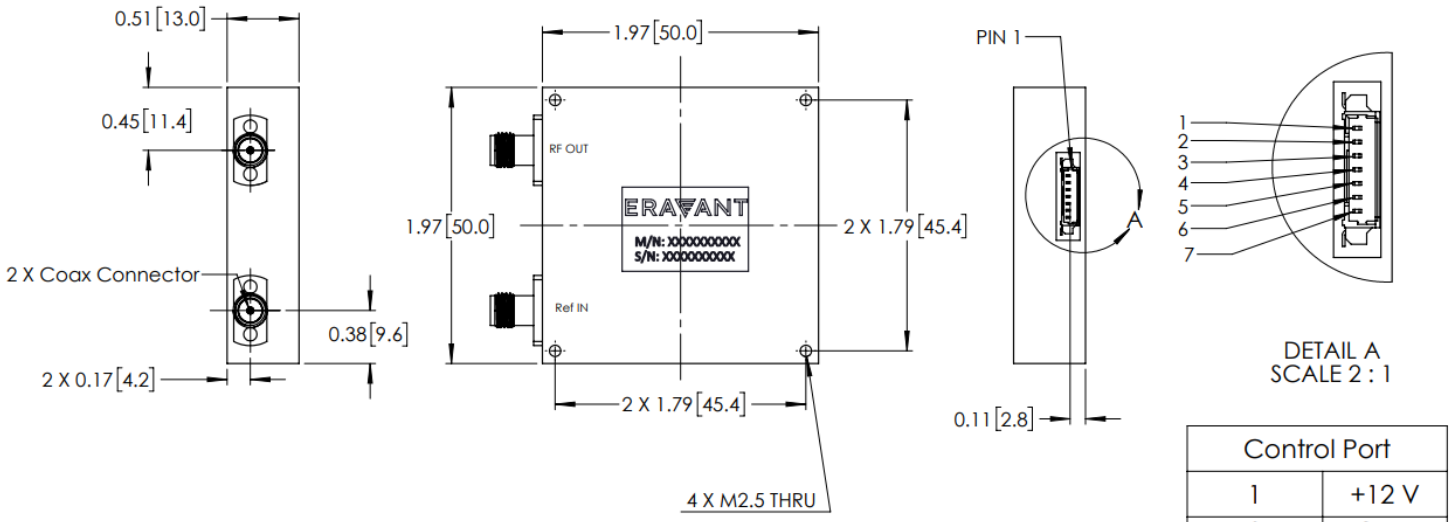
**The unit of synthesized frequency is 0.1 Hz. For example, when frequency is synthesized to 5 GHz, the data in bits [63:16] is 50000000000. The data sent through SPI is 0x02_000BA43B7400_0000. The default synthesized frequency is 10 GHz (0x01_00005AF3107A4000_0000).

Evaluation Kit:

The evaluation kit includes a control board, **SOT-EVA-S1**, and GUI. The control board is not included in this product, but it can be ordered separately. The evaluation kit allows the users to easily set up the system and control the synthesized frequency of this module manually. The computer display of the GUI interface is shown below.



MECHANICAL OUTLINE (Unless otherwise specified, all dimensions are in inches [millimeters])**:**



Control Port	
1	+12 V
2	GND
3	MOSI
4	LE
5	MISO
6	SCK
7	LD

NOTE:

- All testing was performed under **+25 °C** case temperature.
- A well-regulated DC power supply capable of delivering **+12 V_{DC}/1A** is required. The proper pin designation of the power supply on the Micro-D connector is illustrated in the outline drawing above.
- Standard Molex 7-Pin to Micro-D 9-Pin cable and SOT-CC-M7MM9M-S6-P is provided to connect synthesizer with Evaluation Kit SOT-EVA-S1
- External reference phase noise can be estimated from the external reference phase noise + 20*log(N)+3, where N is the multiplication factor.
- The device is controlled via Personal Computer. A parallel-to-serial adapter is needed between the device and PC.

CAUTION:

- The device is static sensitive. Always follow ESD rules when working with the device.
- Wrong bias or reverse bias the synthesizer will damage the device.
- Exceeding absolute maximum ratings shown will damage the device. Use additional heatsink or fan if necessary. The case temperature of the device shall never exceed **+70 ˚C.**
- Proper torque, 8.0 ± 0.15 inch-pounds (0.90 ± 0.02 Nm), should be applied. **Eravant torque wrench, model SCH-08008-S1, is highly recommended**.